THE HARBOR OF NEW YORK

CORPS OF ENGINEERS, U. S. ARMY.
U. S. ENGINEER OFFICE NEW YORK, N. Y.

THE HARBOR OF NEW YORK

IMPROVEMENT
OF
ENTRANCE CHANNELS
AND
NEW YORK AND NEW JERSEY CHANNELS

Prepared under the direction of

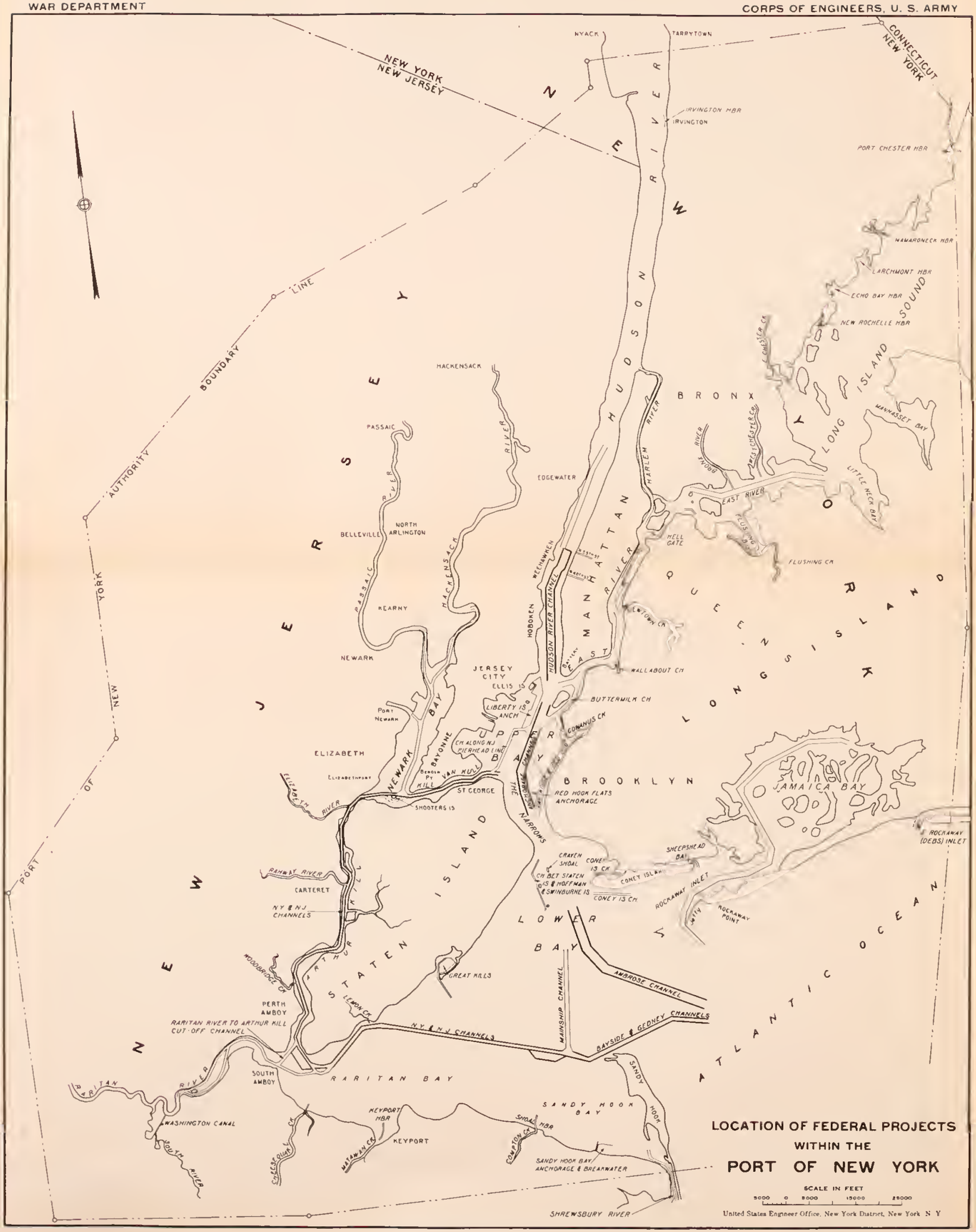
Colonel C. L. Hall, Corps of Engineers

District Engineer, New York District

May 1939

UPPER BAY, NEW YORK HARBOR - GENERAL VIEW LOOKING NORTHEAST

New York Worlds Fair 1939, Inc., in upper right hand corner.



LOCATION OF FEDERAL PROJECTS WITHIN THE PORT OF NEW YORK

SCALE IN FEET

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United States Engineer Office, New York District, New York N Y

8851

THE HARBOR OF NEW YORK

The rich natural advantages of the harbor of New York made its ultimate supremacy predestined. Other splendid harbors in the world surpassed New York in particular aspects but none had the combination of so many inherent possibilities for man to capitalize on nature's bounty. None was so favorably situated for the creation of a magnificent system of water routes engaging in the internal, coastal, and foreign trade. The harbor has been the foremost factor leading to the development of the City of New York to its present rank.

New York Harbor was discovered in 1524 by Giovanni Verrazano, but it remained for Hendrick Hudson, who sailed into the harbor on the "HALF MOON" on September 11, 1609, to discover its commercial possibilities and to explore the great river which now bears his name. It was his recommendation as to its excellence as a "Natural Harbor" that induced representatives of the West India Company of Holland to found the settlement of New Amsterdam. It is a matter of general knowledge that Peter Minuit, acting as an agent of the Dutch West India Company, purchased the Island of Manhattan from the Indians in 1626, with pieces of bright cloth, beads and other trinkets to the value of $24.00 and became its first governor. During this portion of the 17th century, the remarkable Dutch maritime history was at its height.

The Dutch West India Company settled New Amsterdam for the express purpose of establishing a fur trade with the Indians. The relationship between the Dutch and the English, who had settled at

other parts of the Atlantic Seaboard, was not cordial until about 1635, when a considerable change of commodities was commenced. The West India Company's monopoly was broken in 1636 and there was an immediate increase in commerce. In the summer of 1664, four English frigates seized the port. The settlement remained a part of the British colonies until the Revolution.

The main entrance to New York Harbor is through a large open bay, known as the Lower Bay, partially inclosed by Sandy Hook on the south and Rockaway Point on the north. From the Lower Bay, the Narrows, a natural deep tidal strait, about 1 mile wide and 2 miles long, lying between Staten Island on the west and Long Island on the east, leads to the Upper Bay. Upper New York Bay extends from the Narrows to the Battery, the southern tip of Manhattan Island, a distance of about 5 miles. The Upper Bay comprises an area of 17 square miles and has large shoal areas along the easterly and westerly shores. The Hudson River estuary branches off from the Upper Bay and extends northward with New Jersey on the west and the Island of Manhattan on the east. Another large body of water known as Newark Bay is situated west of the Upper Bay and is connected to the Upper Bay by a short strait called Kill Van Kull. Newark Bay is the estuary of the Passaic and Hackensack Rivers. The East River, joining the Upper Bay with Long Island Sound, is a natural rocky strait through which navigation has always been rendered difficult by erratic currents. An old natural channel, now a part of the New York and New Jersey Channels, is situated west of Staten Island. This

Courtesy New York Public Library

NEW YORK FROM BROOKLYN HEIGHTS - 1837

Photo from Phelps Stokes Collection of American Historical Prints.

channel extends from Lower Bay through Arthur Kill to Newark Bay.

The Lower Bay, triangular in shape, comprises an area of 100 square miles, the greater portion of which is occupied by broad shoals. The main shoal, extending from Coney Island to Sandy Hook, was cut by several natural channels maintained by tidal flow. The deepest of these natural channels was known as Gedney, which in 1884 had a controlling depth of 23.7 feet at mean low water, and provided the main route for deeper draft vessels.

The first improvement of New York Harbor by the United States consisted of dredging and removing rock obstructions at Hell Gate, East River, in 1853. Improvements by the Federal Government throughout the harbor have been more or less continuous since 1869. These improvements have been vast and numerous and a description of these projects in their entirety would be so voluminous as to require a publication far beyond the limits of this Information Pamphlet. For this reason the pamphlet is confined only to a description of the development of the main deep draft entrance channels and the present improvement of the New York and New Jersey Channels.

ENTRANCE CHANNELS

In the early days vessels of shallow draft had no difficulty in navigating the natural entrance channels. With the increase of size and draft, however, the natural depth of water in the entrance to the Port was an all important consideration for its success. In 1836, the United States Navy reported that their ships of the line, fully equipped,

Courtesy New York Public Library

NEW YORK - 1855

Governors Island in foreground, Hudson River on the left and East River on the right . Print from Eno Collection.

Courtesy New York Public Library

NEW YORK - 1855

Photo from Phelps Stokes Collection of American Historical Prints.

drew from 24 to 26 feet. Up to the time of the Civil War, navy vessels had deeper draft than most merchant vessels. The celebrated frigate "CONSTITUTION", built in 1797, drew more water than the largest merchant shipping vessel of a half century later. Only twice until the latter half of the 19th century did the depth of water in the entrance to New York Harbor have any important influence on navigation. In both these instances which occurred during periods of war, the vessels probably ran aground on the flats between the deep natural channels.

The Gedney Channel was put to its first severe test on June 28, 1860, when the Steamship "GREAT EASTERN" drawing nearly 27 feet aft, made its first arrival in New York Harbor. After waiting nearly 7 hours for high tide, during which time the cargo was adjusted placing her on an even keel, she passed safely across the bar and proceeded triumphantly to her North River (Hudson River) Pier. The main entrance at Sandy Hook Bar was regarded as adequate for the following two decades. An increasing demand for an improved entrance channel resulted in the appropriation of Federal funds in the amount of $200,000, by the River and Harbor Act of July 5, 1884, for deepening Gedney Channel through Sandy Hook Bar, New York. Since this appropriation was made before any definite project had been established for the improvement of an entrance channel in New York Harbor, a survey of the entire Lower Bay was made. The result of this survey, shown on Plate #1, constituted the basis for the first improvement work.

Preliminary Chart

SURVEY OF PART OF LOWER BAY NEW YORK HARBOR

(to comply with recommendation (July 25th 1884) of Board of Engrs New York city)

made under direction of

Maj. G.L. Gillespie Corps of Engrs.
Bvt. Lieut Col. U.S.A
Aug - Nov 1884.

Act of July 5th 1884 making appropriation of $200000 for deepening Gedneys Channel N.Y Har

Trigonometrical stations & principal verbal points are from data furnished by the U.S Coast & Geodetic Survey

CONEY ISLAND

Hoffmans Island

Dist Pt

East Bank

Romer Shoal

Dry Romer

Channel

Knoll

South Spit

Main Channel

False Hook Channel

SANDY HOOK

Gedney Channel

Swash Channel

Oil Spoil

TIDES

		Sandy Hook Dr.
High water	Mean interval after preceding Transit of the Moon	7 28
Low		13h 44m
Mean Rise and Fall of Tides		6 8ft
Spring Tides		5 6
Neap		4 0

Scales 1:30,000

SOUNDINGS

Soundings are reported in feet and refer to Mean Low water

The 6 ft. Curve is shown thus

12 18 24

U. S. Coast Office
Newton & Grimes 54 New York city
Dec 6th 1884

Forwarded to the Chief of Engrs with report of this date

G.L. Gillespie
Maj of Engrs Bvt Lieut Col U.S.A

PLATE I

At that time it was believed that the dredging of the channel, in itself, would not provide a permanent improvement. Plans were proposed by which the cross section of the entrance would be contracted by the construction of a jetty extending from Coney Island toward the channel with necessary protective riprap around the head of Sandy Hook. The purpose of this constriction was to increase the strength of the current sufficiently to make the channel maintain itself. This plan did not meet with unanimous approval. It was held by some that the jetty would present a permanent obstruction to navigation, especially for smaller vessels whose drafts would not require the use of deeper channels. In view of the large costs involved in the construction of such a jetty, it was decided to experiment first with the dredging plan.

The first contract was awarded to Mr. Roy Stone of New York, on February 7, 1885, on the basis of a guarantee by him, in his bid, to provide a channel 200 feet wide and 28 feet deep at mean low water through Gedney Channel, for a specified sum payable when the channel was completed. While the bid of Mr. Stone was not in reality the lowest, it was considered to be the most acceptable in view of the doubt that existed of the possibility of obtaining a channel of permanent dimensions. Under the accepted bid the Government would incur no expense unless the channel was opened to the specified dimensions.

There had been very little experience in the removal of ocean bars in this country up to this time, and none at all in this vicinity.

Therefore the dredging of Gedney Channel was necessarily considered largely an experimental project. Mr. Stone proposed to remove the shoal by a device known as a marine or hydraulic plow. His equipment consisted of a self-propelled steamer 120 feet in length, equipped with four Worthington duplex pumps with a capacity of 1,250 gallons per minute each. A battery of two pumps was located on each side of the steamer and discharged into a common discharge pipe, 10 inches in diameter and 54 feet in length. These discharge pipes were lowered to the ocean bed and terminated in two 2-inch nozzles which threw jets of water forward and upward. The nozzle pressure was estimated to be 150 pounds per square inch.

The plowing (dredging) operations were conducted only during ebb tide and consisted of moving up and down the channel, the water-jets cutting furrows in the ocean bed and forcing some of the material into the overlying stratum of water. In theory the material agitated by the water-jets would be carried out to sea on the ebb tide. Actual operations were begun on March 24, 1885, and it was shown shortly thereafter by soundings that any material that may have been moved in a seaward direction on the ebb tide was brought back by the flood currents. The contractor abandoned this device on April 26, and substituted an "induction pipe". The induction pipe, 30 inches in diameter was open at both ends, the bottom end of which was bell-mouthed. Two injection pipes terminating in 2-inch nozzles were inserted 7 feet from the bottom, and a third nozzle was located at the bottom of the induction pipe. The theory advanced for this device

was that the material agitated by the lower water-jet would be drawn up through the induction pipe due to the suction caused by the two injection nozzles. The discharge end of the induction pipe was located about 6 inches below the water surface. It was hoped that, by discharging the material near the water surface, a more effective means of transportation by the ebb currents would be realized. This experiment proved to be no more effective than the plow and the contractor finally abandoned the work and withdrew from the contract on May 14, 1885.

The work was readvertised and awarded on July 21, 1885, to Elijah Brainard, who proposed to do the work by means of hydraulic pumps. As there were no hydraulic machines in the country capable of doing the work, Mr. Brainard had the added task of constructing suitable plant.

The introduction of Mr. Brainard's plant to the work on September 26, 1885, was the advent to New York Harbor of the principle of the now efficient and accepted method of dredging ocean bars namely, hopper dredges. While the "Edwards" hydraulic pumps were used initially in dredging ocean bars by General Gilmore, in 1871, at the mouth of Saint John's River, Florida, and subsequently by Captain Eads, at the mouth of the Mississippi River, the developments that have produced the modern hopper dredge follow closely the development of the entrance channels of New York Harbor.

The first plant employed by Mr. Brainard consisted of a dump scow with a centrifugal pump located on the after end. The

16-inch suction pipe was raised and lowered by means of a derrick. The discharge was arranged so that any pocket could be filled independently of the others. The scow had a capacity of 694 cubic yards and was 120 feet long, 40 feet wide and had a draft loaded of 12 feet. The scow was towed by a seagoing tug. This excavator was supplemented the following year by a similar plant. The new plant, equipped with a larger pump and a 22-inch suction, had a capacity of 1,055 cubic yards. On May 9, 1886, Mr. Brainard made a further addition to his plant by placing on the work the self-propelled, 175 cubic yard capacity, hopper dredge, "HOWARD". This plant had been employed the previous year at Charleston Harbor, South Carolina. The "HOWARD" was equipped with an "Edwards" hydraulic pump located low amidships and two 9-inch suctions, one on each side. The load was carried in bins which dumped through side doors. Mr. Brainard's contract was completed in November, 1886.

While the production of the plant employed by Mr. Brainard did not meet the prescribed rate, the results proved beyond a doubt that the method employed was a very practicable solution for dredging ocean bars.

Before the initial dredging of Gedney Channel was completed, recommendations had been made for a 30-foot channel, 1,000 feet wide, extending from the sea to the Narrows. The River and Harbor Act of August 5, 1886, appropriated $750,000 to secure a 30-foot channel at mean low water at the Sandy Hook entrance of the Harbor, under such plans as the Secretary of War would approve. The plan approved by the

Secretary of War was based on the above recommendations. The revised project included Gedney, Main (Bayside) and Main Ship Channels as shown on Plate #2.

Subsequent contract work produced a rapid development of improvements in hopper dredges. Mr. Joseph Edwards was largely responsible for these improvements. The dredging company which bore his name performed the largest part of the work on the modified project, removing a total of 4,300,000 cubic yards during the years 1887 to 1891. Mr. Edwards constructed three self-propelled hopper dredges for this work. The largest, "THE RELIANCE", with a bin capacity of 817 cubic yards was a steam vessel 156 feet in length, equipped with two "Edwards Cataract" pumps each having a 20-inch suction. The results obtained by these dredges were considered highly satisfactory. The project was completed in 1891 at a cost of $1,520,000 and provided the first improved entrance for deep draft vessels into the Upper Bay.

As the above work progressed, various comparative surveys were made to ascertain whether or not the channel dimensions being provided under the contracts were being maintained. These surveys invariably showed that there was little or no tendency for shoals to form in the channel. The opinion was then formed, which experience has since proved to be true, that it would not be necessary to construct the proposed jetty to obtain a reasonable degree of permanency in the improved channel.

The hopper dredge "THE RELIANCE" was purchased by the

IMPROVEMENT OF

NEW YORK HARBOR, NEW YORK.

IN CHARGE OF

LIEUT. COL. G. L. GILLESPIE.

CORPS OF ENGINEERS, U.S.A.

MAP OF THE LOWER BAY

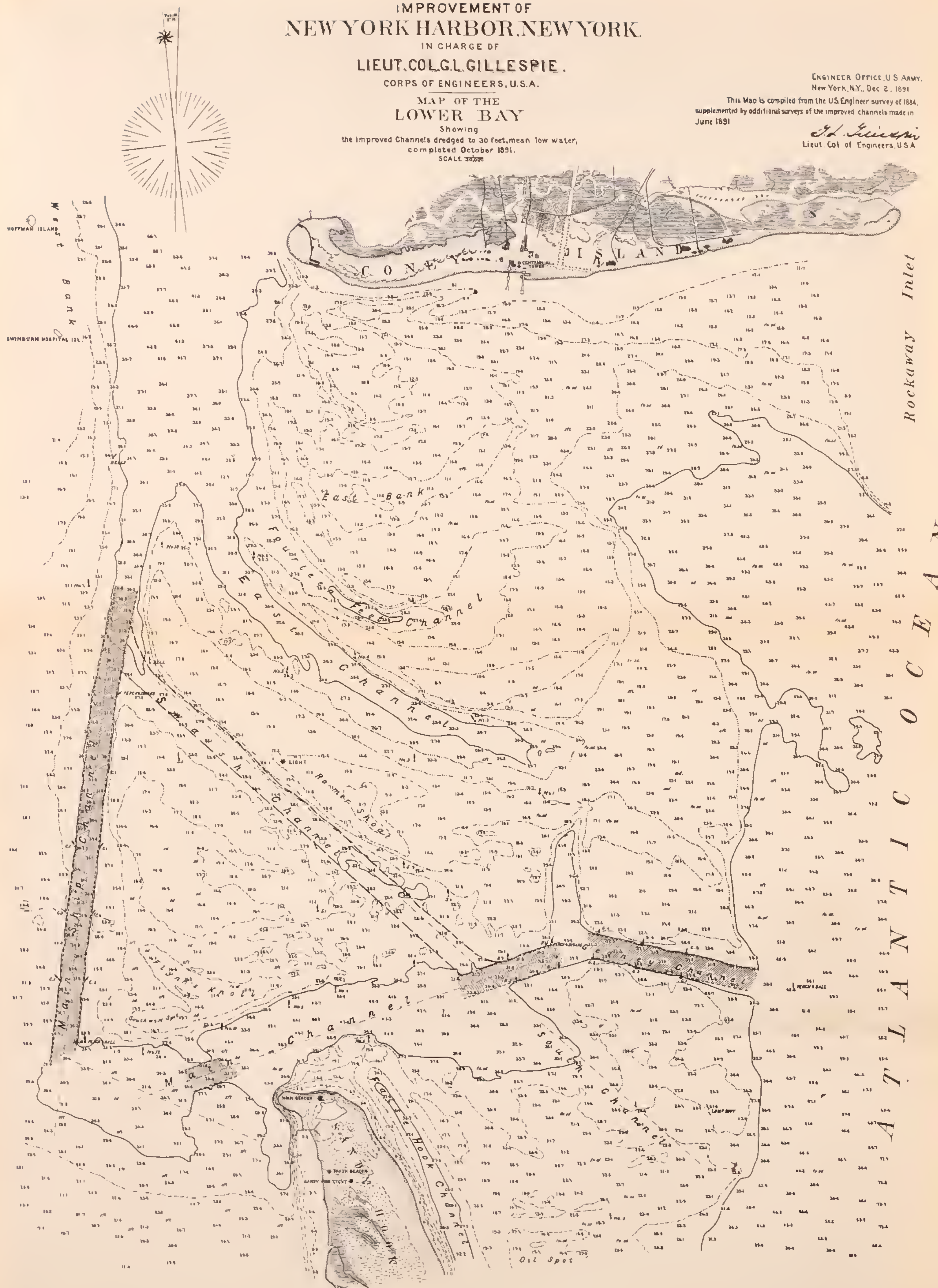
Showing the improved Channels dredged to 30 feet, mean low water, completed October 1891.

SCALE 1/30,000

ENGINEER OFFICE, U.S. ARMY.
New York, N.Y., Dec 2, 1891

This Map is compiled from the U.S. Engineer survey of 1884, supplemented by additional surveys of the improved channels made in June 1891.

G. L. Gillespie
Lieut. Col. of Engineers, U.S.A.



TIDES.

		Sandy Hook Dock
High Water	Mean interval after preceding Transit of the Moon	7h 25m
Low "		13h 44m
Mean Rise and Fall of Tides		4.5 feet
" " " " Spring Tides		5.6 "
" " " " Neap Tides		4.0 "

SOUNDINGS.

Soundings are expressed in feet and tenths and refer to Mean Low Water (U.S.C.S.) at Horseshoe Dock.

The 6 feet curve is shown thus:
" 12 " " " " "
" 18 " " " " "
" 24 " " " " "
" 30 " " " " "

PLATE II

Government in September 1892, to perform maintenance work in the improved channels. The name of the dredge was changed to the "GEDNEY" upon acquisition by the Government.

The growth of commercial vessels kept pace with the channel improvement and, by 1895, the need for increased navigation facilities again became urgent. On June 3, 1896 Congress authorized a survey with a view to providing a 35-foot channel at mean low water from the Narrows to the sea. Studies were thereupon made under the provisions of this authorization. Recommendations were submitted for dredging of East Channel to 40-foot depth and 2,000-foot width. The recommendations were approved and funds were appropriated by the River and Harbor Act of 1899, for the improvement of East Channel. The name of East Channel was subsequently changed by Act of Congress in 1900, to "Ambrose Channel", in honor of Mr. John Wolf Ambrose, who had worked diligently for the improvement of New York Harbor. The channel continues officially to be known by this name.

Dredging of Ambrose Channel was commenced in January 1901, under a contract providing for the removal of an estimated 42,500,000 cubic yards of material. The contractor had heard accounts of the excellent performance of seagoing suction dredges in the improvement of the harbor at Liverpool, England. These dredges, while similar in principle to those used on the project for improvement of Gedney and Main Ship Channels, differed in the method of operation. The English dredges worked while at anchor, digging large holes into which the

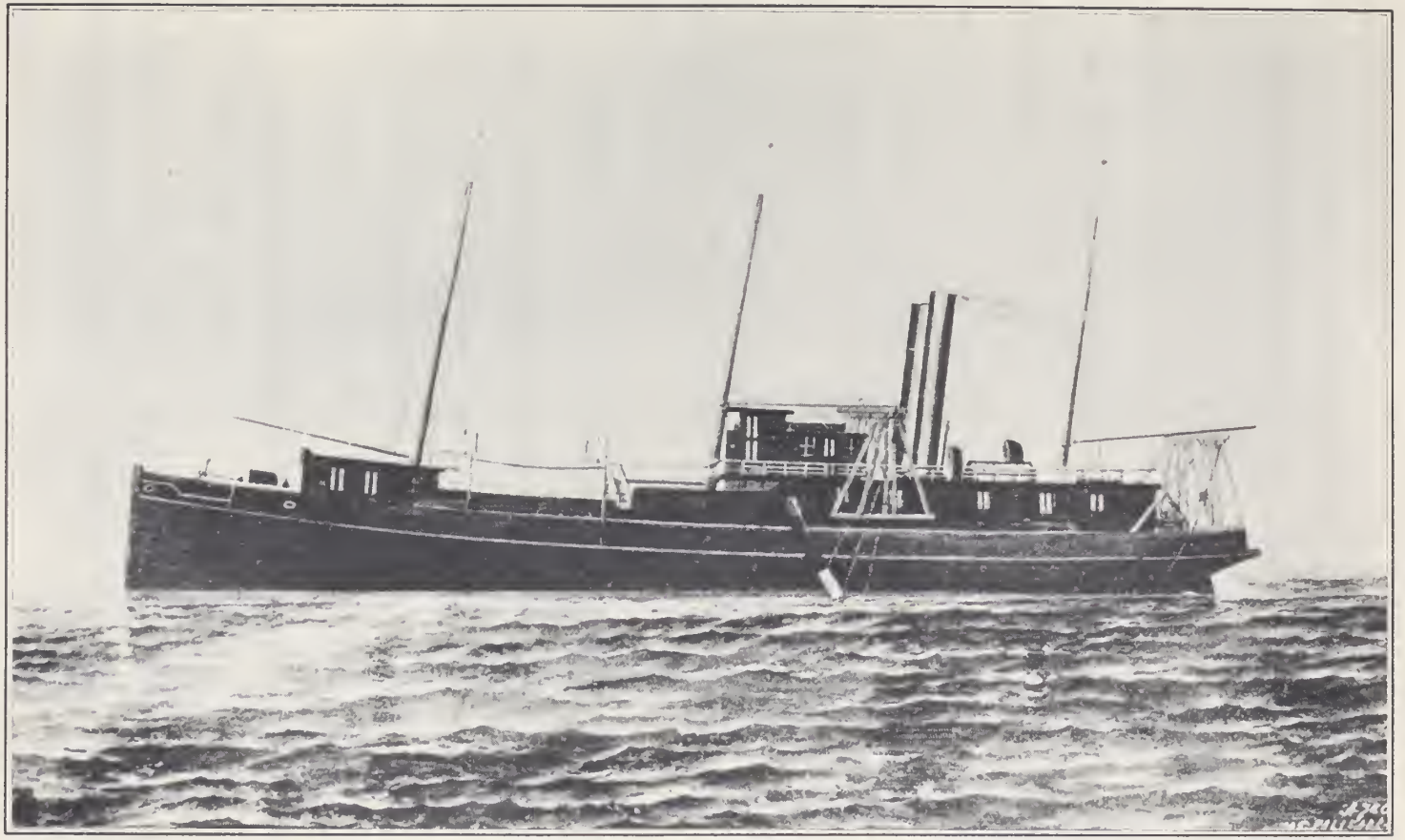


Photo from "Improvement of New York Harbor."

THE RELIANCE

Purchased by the United States in 1892 and renamed "Gedney".
First hopper dredge owned by New York District.

material flowed readily, thus gradually lowering the surrounding bottom. Two dredges similar to those used in Liverpool but twice as large were constructed for use in Ambrose Channel. This type of dredge, having a single suction pipe located amidships, which had worked so admirably in the soft and semi-fluid material encountered in Liverpool, met with some success on the outer end of Ambrose Channel, but proved to be unsuited for the firm, compacted material found throughout the remainder of the channel. It was found from surveys that the dredges made holes 55 feet deep or more, but due to the compacted material these holes did not fill up as expected. As deductions in quantities were made from bin measurements for all material removed below the 40-foot plane, this method of dredging proved financially disastrous to the contractor. The work proceeded very slowly, and the contractor finally abandoned the work in October 1906.

The River and Harbor Act of March 3, 1903 authorized the construction of two Government seagoing hopper dredges to supplement the contract work, which was then far behind the required rate. After the contractor abandoned the work entirely, two additional seagoing hopper dredges, constructed under authority of the River and Harbor Act of 1907, were assigned to the work. Work thereafter was carried to completion with Government-owned-and-operated plant. These new Government dredges reverted back to the method of operation employed by the "GEDNEY" and performed with an efficiency far superior to the methods of operation tried by the contractor.

The project was completed in 1914 and provided a least depth of 40 feet, at mean low water, and a width of 2,000 feet. A total of approximately 66,000,000 cubic yards of material was removed under the project. Although the project was not completed until 1914, the work was performed in such a manner that a useable channel was available for the navigation of deep draft vessels as early as 1907. This fact was attested by the entrance to the harbor of the ill-fated "LUSITANIA", drawing approximately 35 feet, on September 13, 1907.

Upon the completion of Ambrose Channel, regulations were prescribed restricting the channel to navigation by vessels under efficient control with their own motive power and not having barges or other vessels in tow, except in special cases and then only upon written consent of the District Engineer. All navigation forbidden the use of Ambrose Channel is permitted to use the route of the first entrance channels, namely, Main Ship, Bayside (Main) and Gedney Channels.

Natural depths existing in the Upper Bay proved to be sufficient for the needs of navigation until the completion of the 40-foot project in Ambrose Channel. It was found that the anchorage grounds in Upper Bay extended into deep water to such an extent that vessels, utilizing the maximum depth available in Ambrose Channel, were restricted to a channel of 370 feet in width through Upper Bay. This condition presented great difficulties to navigation especially during foggy weather.

Fairchild Aerial Surveys. Inc., N.Y.C.

DOCKING "QUEEN MARY" - HUDSON RIVER CHANNEL

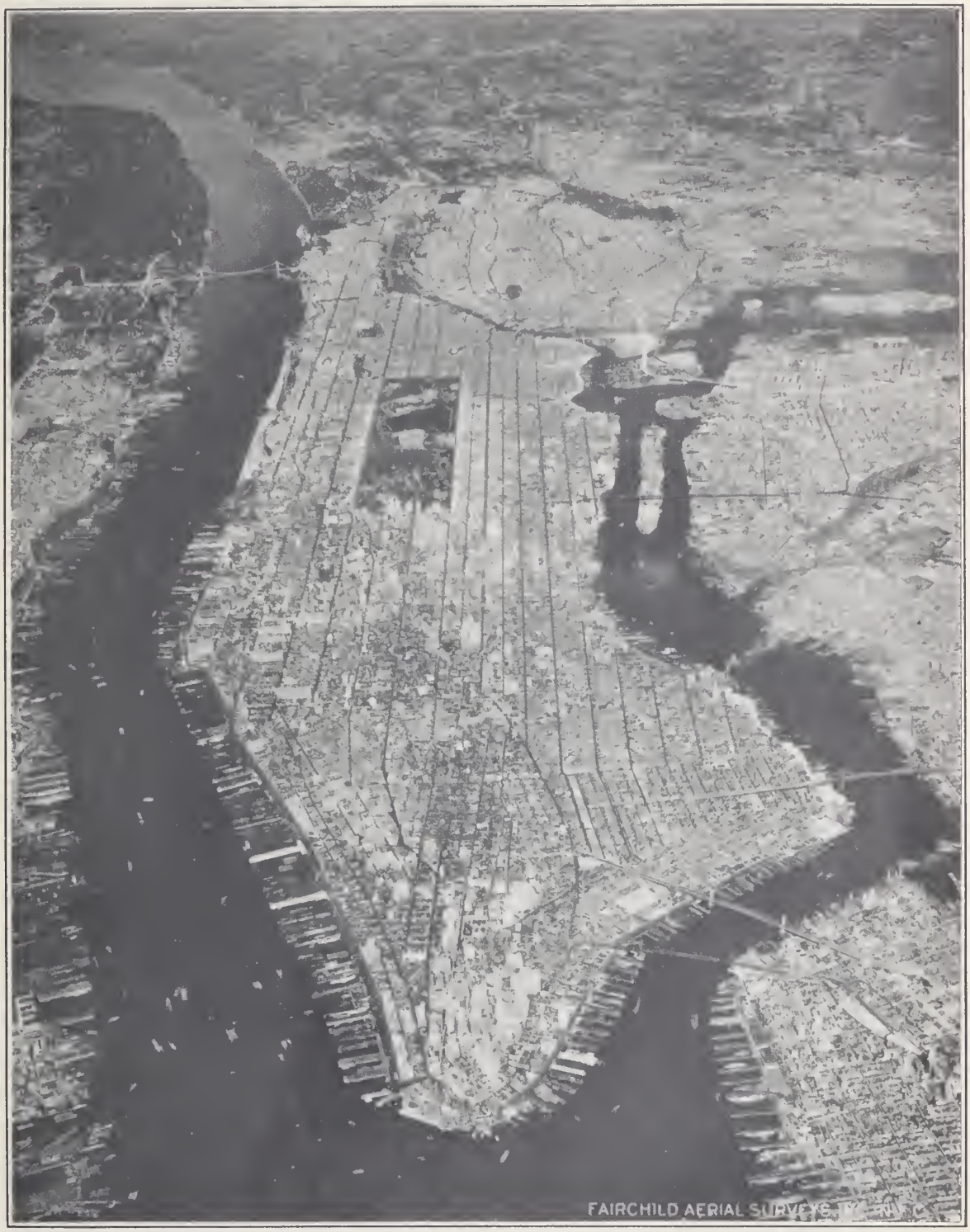
Mid - Manhattan skyline in background.

Fairchild Aerial Surveys, Inc. N.Y.C.

DOCKING "NORMANDIE" - HUDSON RIVER CHANNEL

Recommendations were made under a study authorized by River and Harbor Act of March 4, 1913, to provide for a channel 40 feet deep and 2,000 feet wide as an extension of Ambrose Channel through Upper Bay. The Act of August 8, 1917, authorized the dredging of Anchorage Channel as recommended, and the work was completed in 1929.

Hudson River Channel has also played a major part in the development of the Port of New York. Approximately two-thirds of all craft entering New York Harbor from the Atlantic Ocean through Lower Bay, dock at terminals located on the shores of Hudson River, or use the Hudson in traveling to their destination. The Hudson River, which rises in upper New York State, empties into New York Harbor at the Battery. The New York State Barge Canal, which connects with the Great Lakes, joins the Hudson River at Waterford about ten miles above Albany, New York. The section of river extending from deep water in Upper New York Bay, off Ellis Island, to the northern limits of New York City, a total distance of about sixteen miles, is known as Hudson River Channel. In its original condition there was a channel 40 feet deep with a least width of about 1,000 feet in this portion of the estuary. The first work of improvement in Hudson River Channel was done under authority of the River and Harbor Act of March 3, 1875, and consisted of the removal of mud bars off Jersey City, New Jersey. Progressive authorizations adopted since that time provided for various enlargements of the waterway. In 1935 the existing project for Hudson River Channel was as follows: A channel 40 feet deep for the full



MANHATTAN ISLAND LOOKING NORTH

View of the principal bridges leading to Manhattan; on the left, George Washington bridge spanning the Hudson River; on the right, from bottom to top, Brooklyn, Manhattan, Williamsburg, Queensboro and Triboro bridges spanning the East River.

width of the river from the north line of Fifty-ninth Street, Manhattan, to approximately 1,000 feet north of the Battery, thence a channel of same depth to deep water off Ellis Island and a channel 30 feet deep and 750 feet wide along the Weehawken-Edgewater waterfront.

With the advent of the steamship "NORMANDIE" of the French Line and the steamship "QUEEN MARY" of the Cunard White Star Line, two vessels exceeding in size anything heretofore built, the need for deeper entrance channels became apparent. These ships, as well as all the other large merchant vessels, traverse the route through Ambrose, Anchorage and Hudson River Channels in traveling to their berths located on the Manhattan shore of the Hudson River between 42nd and 59th Streets.

The "QUEEN MARY" and the "NORMANDIE" have a draft fully loaded, of approximately 40 feet, but their draft leaving New York Harbor is usually a little less than 39 feet. Observations of the "QUEEN MARY" made while passing through the Narrows at high tide, at a speed of about 18 knots, indicated a maximum squat of 4.7 feet at the stern. It was found that the squat both bow and stern was very nearly uniform. At a speed of about 12 knots, the squat was reduced to 1.5 feet. The squat of the "NORMANDIE" under the same conditions is probably similar.

From the above data it is evident that project depth greater than 40 feet is necessary for the safe navigation of these vessels. Whether the construction of these large vessels drawing

Courtesy U.S. Army Air Corps

LOWER MANHATTAN, N. Y.

Battery Park at left, Hudson River in background and East River in foreground.

over 39 feet will continue is a matter that only time can answer. The large investments in these vessels, the great number of passengers whose lives would be endangered by inadequate facilities, and the matter of maintaining the position of New York Harbor as a great world port justify a reasonable expenditure to obtain channels of greater depth. With reduced speeds and care in navigation, a depth of 45 feet was considered sufficient for the main through channels for present commerce.

In addition to the difficulties experienced in the entrance channels, very large vessels encounter even greater hazards in Hudson River Channel while angling into their slips. Large super deluxe transatlantic liners over one thousand feet in length, heading into their berths alongside the eleven hundred-foot piers, form a barrier extending over one-third the distance across the Hudson River. The distance between pierheads at this location is approximately twenty-eight hundred feet. Vessels in this position are at right angles to tidal currents and create a large barrier across the natural flow in the estuary. Maintaining control of the ships under these conditions is obviously an exceedingly difficult task. Lack of adequate depth restricted the use of the ships engines in assisting in docking. The size of these vessels presents such a large area of exposure to the wind, that any appreciable breeze increases the difficulties in guiding the craft into their slips. The area in the vicinity of the piers is highly congested with local and through traffic and the danger of collisions is always present.

Courtesy Acme

PASSENGER TERMINAL - HUDSON RIVER CHANNEL

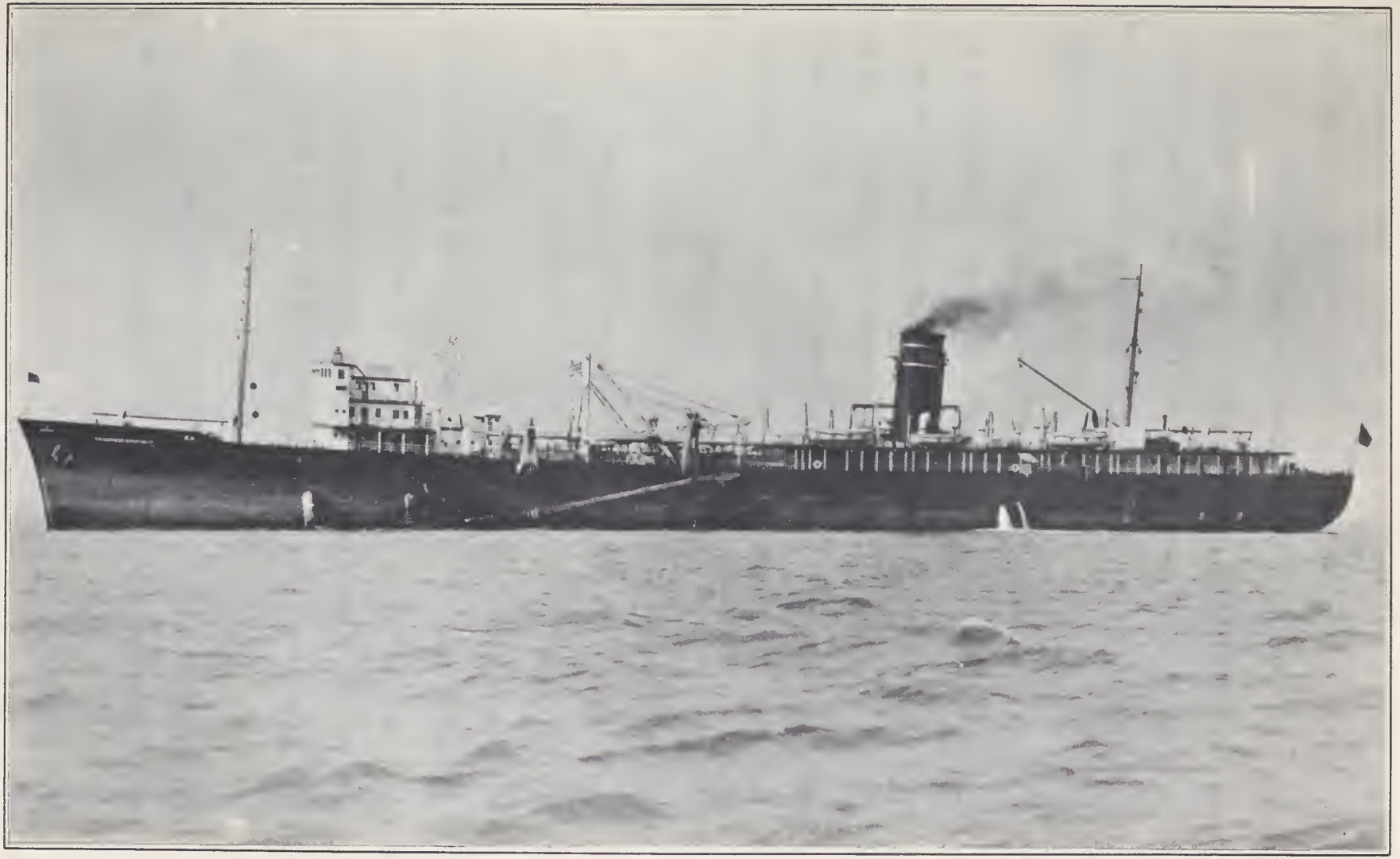
Some of the worlds mightiest merchant vessels at dock, February 4, 1939, having a total tonnage of 355, 275. From bottom to top: Hamburg 22,117; Bremen, 51,730; Columbus, 32,565; De Grasse, 18,435; Normandie, 83,423; Brittanic, 26,943; Acquitania, 45,647; Conte de Savoia, 48,502; Ft. Townshend, 3,424 and Monarch of Bermuda, 22,489.

The justification for depths even greater than 45 feet in an area adjacent to the deep water terminals is evident from the above data. It was considered that a depth of 48 feet would provide enough water under the keel of these boats for maneuverability and for reduction of the objectionable hydraulic conditions.

In accordance with the above conclusions an Act of Congress approved August 28, 1937, authorized a modification of the projects for improvement of Ambrose, Anchorage and Hudson Rivers, to provide for a channel generally 2,000 feet wide from the sea to West 59th Street, Manhattan; 45 feet deep, at mean low water to West 40th Street, and 48 feet deep from West 40th Street to West 59th Street, at an estimated cost of $2,481,000. Work under this latest authorization has recently been commenced. The Government seagoing hopper dredges are actively engaged in deepening the 48 feet deep maneuvering area adjacent to the terminals in the Hudson River.

New York now has the unique distinction of having the berths for the largest seagoing passenger palaces, located practically at the entrance to its finest hotels. Upon completion of the entrance channels to 45 feet, and the maneuvering area to 48 feet, New York City can again boast of its preeminence as a seaport.

Further improvement of Gedney and Bayside (Main) Channels (see page 5), was authorized by the River and Harbor Act of August 30, 1935, to provide for a channel 800 feet wide and 35 feet deep at mean low water. These channels, which were improved originally to provide



UNITED STATES SEAGOING HOPPER DREDGE "GOETHALS"

a suitable entrance to Upper Bay in New York Harbor, now serve mainly as an outlet to the sea for New York and New Jersey Channels. The present project was adopted under the same authority that provided for the existing project for the New York and New Jersey Channels. Dredging operations on this project were commenced in March 1938, with the assignment of the new Government seagoing hopper dredge "GOETHALS".

The introduction of the "GOETHALS" marked another step in the development of seagoing hopper dredges which can be attributed to the experience gained on the operation of this type of dredge on the New York Harbor entrance channels. The "GOETHALS" built in 1937, is the largest and most powerful dredge of this type in the world, displacing 9,000 tons light, and 15,500 tons loaded. She has a bin capacity of 5,000 cubic yards and is capable of dredging to a depth of 50 feet. The principal dimensions of this super dredge are as follows: length, 476 feet; beam, 68 feet; width overall, 89 feet 11 inches; draft, loaded, 25.5 feet. Four oil-burning boilers, operating at a pressure of 400 pounds per square inch, supply steam to the turbo generators which, in turn, supply electricity to the two 2,250 h.p. propulsion motors and the two 1,300 h.p. motors each of which operate a 30-inch dredging pump. The dredge has a maximum speed of 15.5 statute miles per hour, light and of 12 statute miles per hour, loaded.

It is expected that the existing projects for New York Harbor will satisfy the needs of navigation for sometime to come.

In view of the steady increase in vessel draft during the past fifty years or more, it remains to be seen whether the limit in practical size of vessels has now been reached.

TERMINALS AND COMMERCE

New York Harbor has a water frontage of about 770 miles. The extent of docking facilities located along the frontage, amounts to nearly 350 miles, measured around piers and slips. The developed frontage includes approximately 900 piers of which the City of New York owns more than twenty-five percent. The remainder of the piers is owned largely by private interests, principally railroad and terminal companies, although a few are owned by the United States, the States of New York and New Jersey, and the various municipalities lying within the jurisdiction of the port. The exceptional configuration of New York Harbor has provided almost unlimited room for expansion. In addition the harbor has ample space for anchorage.

The scope of the terminals is large and varied, including facilities for the storage and handling of all kinds of commodities. No other port in the world has better facilities for handling commerce in such large quantities.

The port is served by twelve railroads, operating nearly 40,000 miles of line, which connect with all points in the country. These railroads have developed a highly efficient lighterage and carfloat system to transport freight from one terminal to another. In this way they have overcome the obstacle presented by the numerous waterways which otherwise would isolate many sections of the port from railway facilities.

The commerce of the Port of New York, the major portion of which passes through the main entrance channels, consists of widely varying classes of commodities, both foreign and domestic, and includes the largest passenger steamships in the world, engaged in the transatlantic trade.

The imports consist chiefly of fuel oil, crude oil, sugar, fruits, coffee, flaxseed, rubber, gypsum and paper. The principal exports are iron, steel, refined oils, automobiles and accessories, wheat, fodders and food, and flour.

According to the latest published statistics, for the calendar year 1937, the Port of New York handled 20.8% by weight and 54.6% by value of the entire water-borne commerce of the United States. The value of foreign trade ($5,735,632,019) handled during the calendar year 1937 shows an increase of approximately 620% over the year 1884, when improvement of the entrance channels was commenced. This increase shows in part, the justification for the improvements to the entrance channels

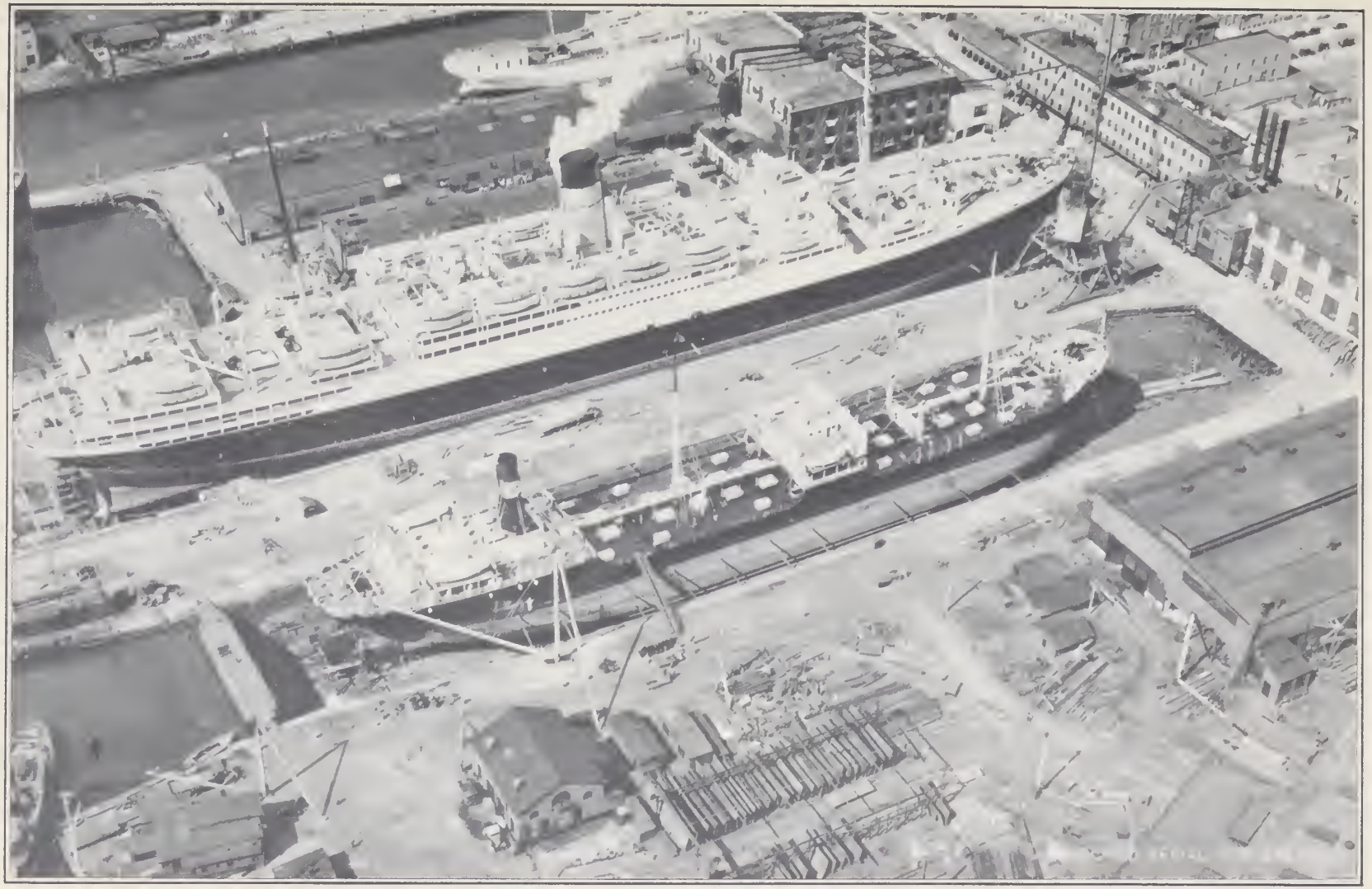
Courtesy U.S. Army Air Corps

BROOKLYN NAVY YARD - EAST RIVER, N. Y.

Manhattan Island in background.

Courtesy U.S. Army Air Corps

UNITED STATES ARMY BASE - BROOKLYN, N. Y.



Courtesy Todd Shipyards Corp.

GRAVING DOCKS - ROBINS DRY DOCK & REPAIR CO , ERIE BASIN, BROOKLYN, N. Y.

View shows steamship Lancaster in largest graving dock in New York Harbor. Dock dimensions, length 731 feet, width 89 feet, depth on sill 32 feet 5 inches

Courtesy Todd Shipyards Corp.

ROBINS DRY DOCK & REPAIR CO., - ERIE BASIN, BROOKLYN, N. Y.

Pier in foreground constructed entirely of foreign soil carried to New York as ballast.

Courtesy New York Dock Co.

ATLANTIC BASIN AND TERMINALS, NEW YORK DOCK CO. BUTTERMILK CHANNEL

New York Dock Co. piers extend two and one-half miles along the Brooklyn waterfront.

Courtesy Bush Terminal Co..

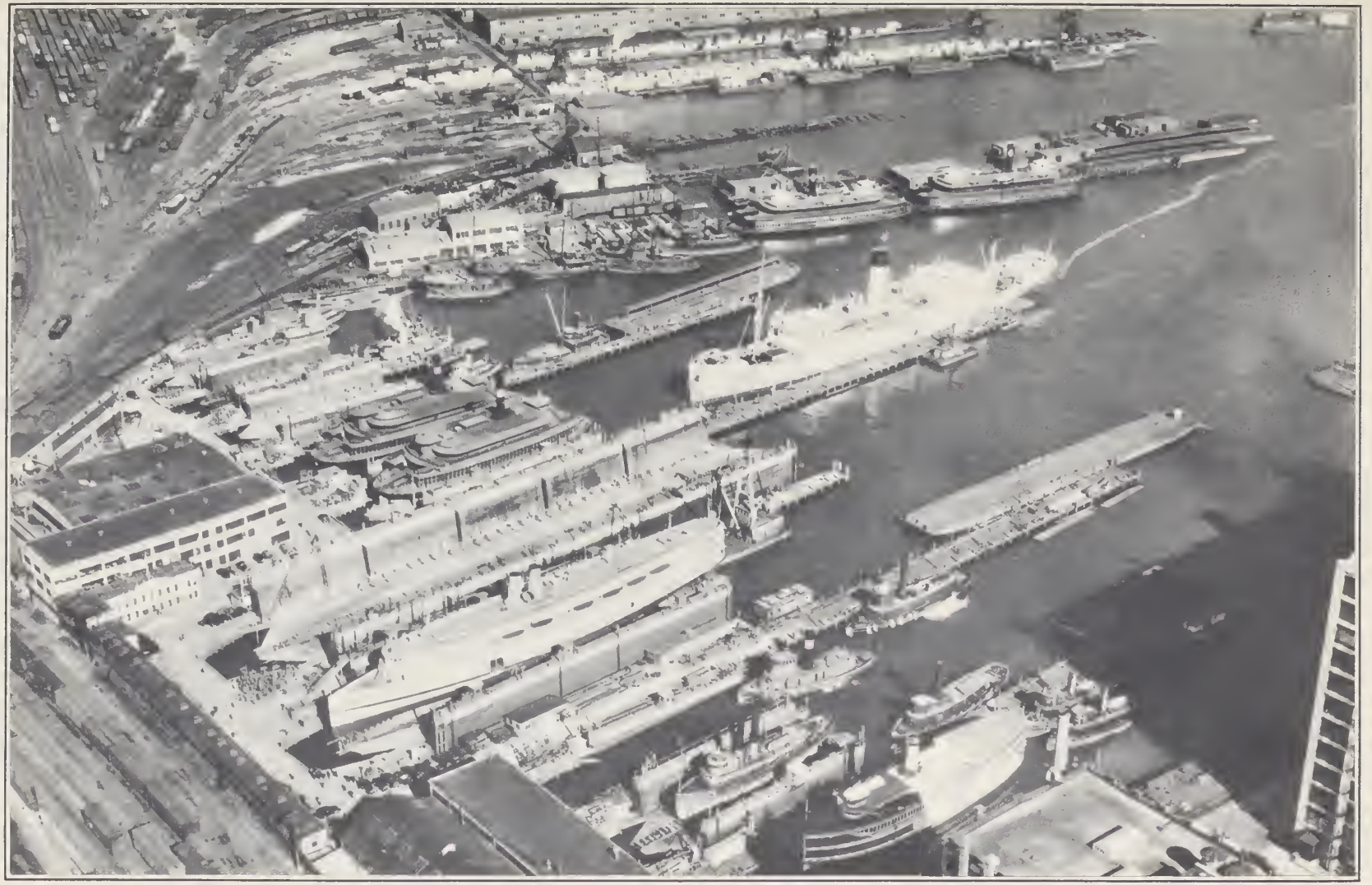
BUSH TERMINAL CO. PIERS - BAY RIDGE CHANNEL

One of the large private terminal developments, pier area 1,800,000 square feet.

Courtesy U.S. Army Air Corps

TERMINALS OF FIVE LARGE RAILROAD COMPANIES - JERSEY CITY, N. J.

Hudson River on the left, Upper Bay and the Narrows in background.



Fairchild Aerial Surveys, Inc. N.Y.C.

REPAIR YARD, TIETJEN & LANG DRY DOCK CO., - HOBOKEN, N. J.

NEW YORK AND NEW JERSEY CHANNELS

The project known as New York and New Jersey Channels derives its name from the fact that the waterway coincides more or less, with the boundary line of the States of New York and New Jersey. It extends for a distance of 30.8 miles from its junction with Bayside-Gedney Channel, northwest of Sandy Hook through Lower New York and Raritan Bays, around Staten Island, through Arthur Kill, Newark Bay and Kill Van Kull to deep water in Upper New York Bay.

Prior to improvement of this waterway by the United States, the natural channels were, for the most part, shoal and sinuous. The controlling depths at various localities were as follows: in Kill Van Kull 25 feet; across the lower end of Newark Bay, between Bergen Point and Elizabethport, 9-1/2 feet; in Arthur Kill, 10 feet; in Raritan Bay, 14-1/2 feet.

The first work in the development of the project was done under an Act of Congress of June 23, 1874, authorizing "The Channel Between Staten Island and New Jersey"; providing a channel of 14 to 16 feet deep by diking and dredging between Elizabethport and the westerly end of Shooters Island. Work in Raritan Bay was first authorized in 1881, subsequently extended in 1890 and 1896 to provide a 21-foot channel to Perth Amboy. Since the initial projects, many modifications have been authorized extending, widening and deepening the channels.

The present project was adopted by the River and Harbor Act

of August 30, 1935. The channel lengths of the various sections are as follows: Across Raritan Bay to Perth Amboy, 12.6 miles; between Staten Island and New Jersey through Arthur Kill to Newark Bay, 12.4 miles; across Newark Bay, 1.5 miles; and through Kill Van Kull to Upper New York Bay, 4.3 miles. The project depth is 37 feet in rock and 35 feet in soft material, except for a stretch of about 7 miles in Arthur Kill, which is to remain at a depth of 30 feet as authorized by the River and Harbor Act of September 22, 1922. The width of the channel varies in different localities, from 800 feet in Kill Van Kull to 600 feet in Arthur Kill, except for a small section in the vicinity of Elizabeth, where the width is further reduced to 500 feet. The channel is widened at the bends to provide additional steerageway, especially for ships passing each other. The project also provides for two anchorages 38 feet deep to accommodate 5 vessels each; one near Sandy Hook and one south of Perth Amboy. The project was approved subject to the following conditions of local cooperation, all of which are being fulfilled:

> "(a) That where the project channel encroaches upon upland property and extends shoreward of harbor lines, the completion of the encroaching portions of the project shall be deferred until the necessary rights-of-way for channel purposes shall have been granted free of cost to the United States;" and

"(b) That local interest provide areas of land adjacent to the waterway, free of cost to the United States, for the disposal of dredged materials, except where, in the judgment of the Chief of Engineers, no suitable disposal areas exist."

The estimate of the cost of this project, excluding cost of work accomplished in these waterways under previous projects, is $27,369,000, with an estimated annual cost of maintenance of $195,000. Eight or nine years will be required to complete the project, depending upon the rate funds are allotted for the work.

The approximate amount appropriated and allotted for work under the project to date is $12,708,000, of which $807,000 was allotted from Public Works funds, and $2,000,000 from Emergency Relief funds. The amount expended to January 31, 1939 was approximately $10,465,000. The unexpended balance will be used for work under existing contracts. The magnitude of this project is evident by the quantity of material to be removed, approximately 45,000,000 cubic yards. The greater portion of this material can be removed without difficulty; however, there are 2,103,000 cubic yards of soft rock, some of which may be dredged with a powerful dipper dredge without drilling and blasting, and 2,494,000 cubic yards of very hard rock which must be drilled and blasted before it can be dredged.

The most interesting, as well as the slowest and most costly, feature of the work for these channels is the removal of the hard rock. It has been found from experience that the initial removal

DREDGING AND ROCK REMOVAL - N. Y. & N. J. CHANNELS

Contractor's plant at work off Bergen Point, Bayonne, N. J.

of as much as possible of the material overlying the rock facilitates the removal of the rock. This overburden is removed by powerful dipper type dredges, after which, the rock is broken up, by blasting, into pieces that can be handled readily by the dredges. This rock, commonly known as trap rock, is very hard, dense, fine-grained and heavy. Although it is difficult to drill, it shatters well when blasted.

The rock encountered in the vicinity of Bergen Point is a prolongation of the rock forming the Palisades of the Hudson River. For some distance south of Bergen Point, this ridge remains at a considerable depth, then it emerges in the channel opposite Carteret and again opposite the mouth of Woodbridge Creek.

Ledge rock reaches to a maximum height of 2 feet below mean low water in the vicinity of Bergen Point,making a maximum rock cut of 35 feet to the project depth of the channel which is 37 feet below mean low water.

The channel dimensions adopted by this project are designed to accommodate the largest freight vessels in use today, drawing up to 32 feet, at all stages of tide, except in the 7 mile reach of Arthur Kill where the depth is to remain 30 feet. Deep draft vessels do not ordinarily pass through the entire waterway, but use the entrance nearest the terminal to which they are bound. The comparatively few larger vessels which do penetrate into the 7 mile reach of Arthur Kill near the middle of the waterway will still have to take

advantage of favorable tides to reach their destination. When this section becomes more highly developed and its enlargement becomes economically sound, steps will undoubtedly be taken by the proponents of the improvement of this waterway to have the depth made uniformly 35 feet throughout the entire channel. The progressive improvement of the New York and New Jersey Channels is due largely to the untiring efforts and advocacy of the Staten Island Sound Deep Waterways Association. This Association, which has been in existence about twenty-eight years, includes in its membership a large number of the industrial and manufacturing organizations located along the waterway.

The New York and New Jersey Channels serve an industrial section where the larger industries predominate. Some of the greatest developments in the world for the storage, refining and distribution of petroleum and petroleum products are located along its shores. Practically every major oil company engaged in business in the metropolitan area of Greater New York has a plant located along this waterway. Other major industries located along the waterway include fertilizer, chemical, asphalt, soap and smelting plants. A large part of the coal consumed in the New York metropolitan area and in New England, for industrial and home consumption, is brought to eastern rail heads or tidewater coal terminals on this waterway by the Pennsylvania, Lehigh Valley, New Jersey Central, Philadelphia and Reading, and Baltimore and Ohio Railroads. The coal is then transported from these tidewater terminals located between South Amboy, N. J. and St. George, Staten Island, N. Y., to Upper New York

Harbor. This coal is usually carried in large flotilla tows consisting of as many as thirty barges in one tow.

The New York and New Jersey Channels are an integral part of the Port of New York. The importance of this waterway is reflected by the volume and value of its commerce which in 1937 amounted to 45,034,822 short tons, valued at $887,992,169 and was slightly more than 37 percent by weight, of the total commerce of the Port. By comparison with other waterways, the commerce for New York and New Jersey Channels during the calendar year 1937 was more than 1.8 times by weight the commerce for the same period for the Port of Philadelphia, more than 2.4 times that of the Port of Boston, more than 2.1 times that of Los Angeles Harbor, and about 1.3 times that passing through the Panama Canal.

It is anticipated that there will be a considerable increase in commerce over this waterway when the project is completed. Several large concerns have indicated that their terminals along the waterway will be considerably enlarged, which will result in a vast increase in the commerce transported through the channels. At the present time, there still remain about 10 miles on the New York shore and 5 miles on the New Jersey shore, which have not been developed. These sections afford ample opportunity for the future expansion of industrial development in the area served by the New York and New Jersey Channels.

Courtesy Standard Oil Co. of N.J.

STANDARD OIL TANK FARM - ARTHUR KILL, LINDEN, N. J.

Goethals Bridge in foreground.

Fairchild Aerial Surveys, Inc. N.Y.C.

TIDEWATER OIL CO. PLANT - ARTHUR KILL, BAYONNE, N. J.

Courtesy Standard Oil Co. of N.J.

STANDARD OIL REFINING PLANT - KILL VAN KULL, BAYONNE, N. J.

FEDERAL PROJECTS FOR IMPROVEMENT OF RIVERS AND HARBORS
LOCATED WITHIN THE JURISDICTION OF THE PORT OF NEW YORK

Project and Description	Depth M.L.W. (ft)	Width (ft)	Length (mi)
Port Chester Harbor, N. Y.-			
Long Island Sound to Fox Island	12	150	0.6
Fox Island to 900 ft. below Mill St. Bridge	10	100	0.9
900 ft. below Mill St. Bridge to 100 ft. below Mill St. Bridge	3	175 to 100	0.2
Anchorage near breakwater at entrance	12	-	-
Turning basin opposite steamboat landing	10	-	-
Mamaroneck Harbor, N. Y.-			
Long Island Sound to 150 ft. below Boston Post Road	10	100 to 80	1.3
Branch channel in East Basin	10	80	0.1
Branch channel to West Basin	6	80	0.5
Anchorage in East Basin	10	-	-
Anchorage in West Basin	6	-	-
Larchmont Harbor, N. Y.-			
Removal of Huron Rock	14	-	-
Breakwater 1440 ft. in length			
Echo Bay Harbor, N. Y.-			
Echo Bay to city wharf at Beaufort Point	10	100	0.3
Turning basin at head of project	10	-	-
New Rochelle Harbor, N. Y.-			
Glen Island to 300 ft. below dam	8	120	0.6
East Chester Creek, N. Y.-			
Long Island Sound to 300 ft. above Fulton Ave. Br.	8	150 to 70	4.7
Passing basin below Boston Post Rd. Br.	8	-	-
Westchester Creek, N. Y.-			
East River to East Tremont Ave.	12	100 to 60	2.6
Turning basin at head of navigation	12	-	-

Project and Description	Depth M.L.W. (ft)	Width (ft)	Length (mi)
Westchester Creek, N. Y.- (Cont'd.)			
Turning basin near Eastern Boulevard Bridge	12	-	-
Bronx River, N. Y.-			
East River to dam at E. 177th St.	10	100	3.3
Turning basin near head of navigation	10	-	-
Harlem River, N. Y.-			
East River to Hudson River (Depth increased to 18 ft. in rock cut west of Broadway Bridge.)	15	350 to 400	8.0
Manhasset Bay, N. Y.-			
Manhasset Bay to Crampton Bros. wharf at Great Neck	8	100	1.4
Turning basin near the head of project	8	-	-
Harbor at Flushing Bay, N. Y.-			
East River to Main St. Bridge	12	200 to 160	3.2
Branch Channel from Main Channel to Maneuvering Area	12	200	0.2
Channel along west shore of bay between two municipal boat basins	6	150	1.1
Maneuvering area outside municipal boat basin at south end of bay	12	-	-
Anchorage west of branch channel	8	-	-
East River, N. Y.-			
Upper Bay to Brooklyn Navy Yard	40	1000	2.6
Brooklyn Navy Yard to Throgs Neck	35	550 to 1000	13.4
Branch channel east of Welfare Island	30	500 to 900	1.2
Channel between South Brother and Berrian Ids.	20	300	0.4
The removal of isolated rock reefs to give access to wharves.			
Newtown Creek, N. Y.-			
East River to 150 ft. north of Maspeth Ave.	23	130	2.8
Branch channel in East Branch	20	125 to 150	0.4
" " " Dutch Kills	20	75 to 100	0.5
" " " Maspeth Creek	20	100	0.4

Project and Description	Depth M.L.W. (ft)	Width (ft)	Length (mi)
Newtown Creek, N. Y.- (Cont'd.)			
Branch channel in English Kills-			
Main Channel to Metropolitan Ave. Bridge	20	150	0.6
Metropolitan Ave. Bridge to within 80 ft. of Montrose Ave. Bridge	12	100	0.5
Turning basin at Mussel Island	23	-	-
Turning basin at the head of Dutch Kills	20	-	-
Wallabout Channel, N. Y.-			
East River to Wallabout Basin	20	230 to 350	0.4
Buttermilk Channel, N. Y.-			
East River to Anchorage Channel	*40 & 35	1000	2.3
*(Easterly half of channel 40 ft. deep. (Westerly half of channel 35 ft. deep.			
Bay Ridge & Red Hook Channels, N. Y.-			
Narrows to Buttermilk Channel	40	1200 to 1750	4.0
Gowanus Creek Channel, N. Y.-			
28th St. to Percival St.	26	300 to 200	0.6
Percival St. to Hamilton Ave..	18	200 to 100	0.2
Coney Island Creek, N. Y.-			
Gravesend Bay to Shell Road	12	70 to 150	2.0
Coney Island Channel, N. Y.-			
Norton Point to Steeplechase pier	20	600	1.3
Sheepshead Bay, N. Y.-			
Atlantic Ocean to Sheepshead Bay	6	100	0.3
Jamaica Bay, N. Y.-			
Atlantic Ocean to Cornell Creek	30	1500 to 1000	14.8
One or two rip-rap jetties at entrance, if necessary.			
East Rockaway (Debs) Inlet, N. Y.-			
Atlantic Ocean to East Rockaway Inlet	12	250	0.6
Jetty on east side of entrance, 4250 ft. in length.			
Proposed jetty on west side of entrance, 3000 ft. in length.			

Project and Description	Depth M.L.W. (ft)	Width (ft)	Length (mi)
New York Harbor, N. Y.- Entrance Channels -			
Ambrose-Atlantic Ocean to Narrows	45	2000	10.2
Bayside-Gedney-Atlantic Ocean to Main Ship	35	800	6.0
Main Ship - Bayside Channel to Narrows	30	1000	5.5
In Lower Bay, Bell Buoy 23 to Hoffman & Swinburne Islands	16	200	2.3
Removal of Craven Shoal in Lower Bay	30	-	0.6
Anchorage - Through Upper Bay	45	2000	5.7
Channel along N.J. pierhead line in Upper Bay	20	500	3.0
Anchorage at Red Hook Flats, in two adjoining sections	40 & 30	-	-
Anchorage in vicinity of Liberty Island	20	-	-
Great Kills, S. I., N. Y.-			
Lower Bay to westerly end of Crooks Island and thence along the west side of the harbor	10	150	1.9
Anchorage inside harbor	8	-	-
Lemon Creek, S. I., N. Y.-			
Princess Bay to Anchorage Basin	8	100 to 70	0.5
Anchorage at head of project	8	-	-
N. Y. and N. J. Channels			
Bayside-Gedney Channel to 1000 ft. north of Smith Creek	35*	600 to 800	16.0
1000 ft. north of Smith Creek to 1000 ft. south of Buckwheat Island	30	600	7.0
1000 ft. south of Buckwheat Island to Upper New York Bay	35*	500 to 800	7.8
*Depth increased to 37 ft. in rock areas.			
Anchorage in the vicinity of Sandy Hook	38	-	-
Anchorage south of Perth Amboy	38	-	-
Sandy Hook Bay, N. J.-			
Dredging of area between breakwater and pierhead line	8	-	-
Rubble mound breakwater 4000 ft. in length.			

Project and Description	Depth M.L.W. (ft)	Width (ft)	Length (mi)
Shoal Harbor and Compton Creek, N. J.-			
Sandy Hook Bay to Main St. Bridge across Compton Creek	8	150 to 75	1.3
Keyport Harbor, N. J.-			
Raritan Bay to Steamboat dock at Keyport	8	200	1.0
Matawan Creek, N. J.-			
Keyport Harbor to New York & Long Branch R. R. Bridge	4	100 to 75	2.0
Cheesequake Creek, N. J.-			
Raritan Bay to mouth of creek	5	100	0.3
Mouth of creek to head of navigation	4	100 to 50	3.2
Branch channel in Stump Creek	3	50	0.7
Two jetties parallel to entrance channel.			
Raritan River to Arthur Kill, N.J.-Cut-off Channel-			
Raritan River channel to southern end of Arthur Kill Channel	20	800	1.3
Raritan River, N. J.-			
N. Y. & N. J. Channel to junction with south channel opposite Keasby	25	300	4.3
Junction with south channel to Washington Canal	15	200	4.3
Washington Canal to entrance of Delaware & Raritan Canal at New Brunswick	10*	100	5.2
South channel - from junction with main channel opposite Keasby to Titanium Pigment Co.	25	300	0.7
Titanium Pigment Co. to junction with main channel at Crab Island	10	150	2.5
*Depth increased to 11 ft. through rock areas.			
Washington Canal & South River, N. J.-			
Raritan River to Old Bridge	12	100 to 150	5.2
Woodbridge Creek, N. J.-			
Arthur Kill to Salamander Dock	8	50	1.9

Project and Description	Depth M.L.W. (ft)	Width (ft)	Length (mi)
Rahway River, N. J.-			
Arthur Kill to above Lambert's Wharf	8	100	2.5
Turning basin at head of improvement	8	-	-
Elizabeth River, N. J.-			
Arthur Kill to Baltic Street Bridge	12	60	1.1
Newark Bay, Hackensack & Passaic Rivers, N. J.-			
Channel through Newark Bay to junction of Passaic & Hackensack Rivers	30	2200 to 400	4.7
Branch channel to Port Newark Terminal	30	400	0.2
Hackensack River-Newark Bay Channel to 2000 ft. north of D.L. & W. R.R. Bridge	30	400 to 300	3.9
D.L. & W. R.R. Bridge to N.Y.S. & W. R.R. Bridge	12	200 to 150	12.6
Passaic River-Newark Bay Channel to 3000 ft. above Lincoln Highway Bridge	30	300	2.6
3000 ft. above Lincoln Highway Bridge to Nairn Linoleum Works	20	300	4.4
Nairn Linoleum Works to M. & G. Lake R. R. Br.	16	200	1.1
M. & G. Lake R.R. Bridge to Eighth St. Bridge, Passaic	10	150	7.3
Hudson River Channel, N. Y.-			
Upper Bay to W. 40th St., Manhattan	45	2000	4.8
W. 40th St. to W. 59th St., Manhattan	48	2000	0.9
Upper Bay to W. 59th St., Manhattan	40	*	5.2
Along the Weehawken-Edgewater waterfront	30	750	5.3
*Extends east and west from the 45-foot channel to the pierhead lines.			
Irvington Harbor, N. Y.-			
Dredging of an area lying between deep water in Hudson River and a line 100 ft. channelward of the Turner Lumber Co. wharf	27	-	0.3

COMMERCE OF PORT OF NEW YORK

Net Tonnage
(Short tons)

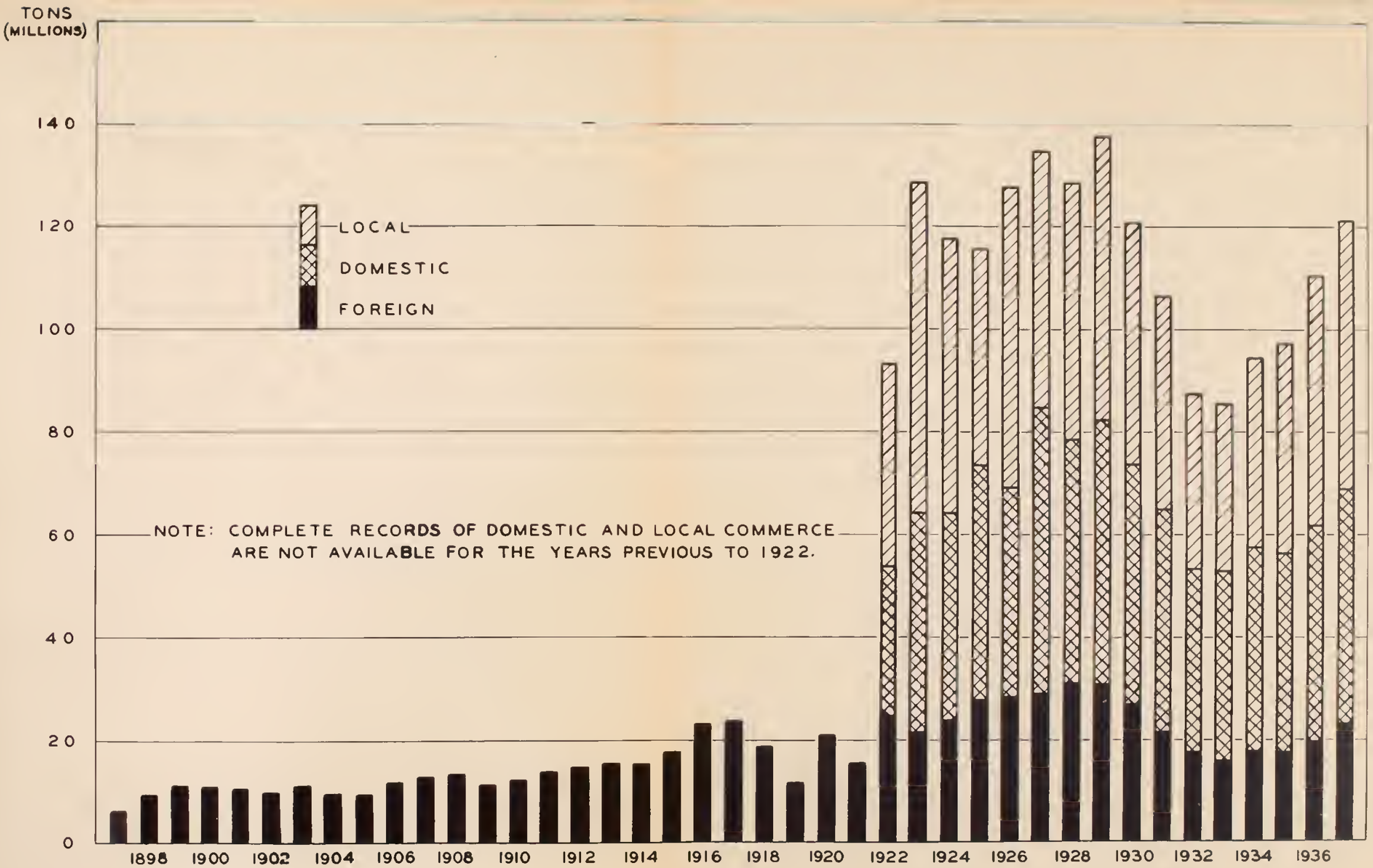
Calendar Year	Foreign		Domestic		Local	Total
	Imports	Exports	Receipts	Shipments		
1937	14,858,639	8,065,031	35,168,015	10,468,687	52,957,048	121,517,420
1936	13,479,929	5,926,044	32,158,864	10,192,732	48,940,119	110,697,688
1935	11,685,466	5,770,865	28,836,190	9,690,286	41,086,100	97,068,907
1934	11,915,432	5,979,143	30,541,475	9,367,630	36,609,854	94,413,534
1933	11,333,103	4,655,104	27,546,835	9,093,916	32,939,244	85,568,202
1932	12,746,613	4,883,801	27,507,451	7,884,667	34,710,927	87,733,459
1931	14,751,190	6,924,398	34,318,635	8,854,758	41,364,792	106,213,773
1930	17,585,796	9,036,372	36,578,630	10,420,804	46,774,043	120,395,645
1929	19,360,420	11,138,761	38,105,427	13,259,954	55,367,299	137,231,861
1928	17,865,043	12,799,277	36,326,829	11,828,323	50,211,487	128,030,959
1927	15,789,784	13,040,859	38,401,343	17,550,644	49,920,968	134,703,598
1926	15,705,760	12,438,369	28,475,926	12,599,375	58,713,817	127,933,247
1925	15,314,804	12,557,296	31,468,230	13,917,467	42,464,231	115,722,028
1924	10,243,429	13,537,963	28,781,598	11,203,756	54,098,650	117,865,396
1923	10,855,747	10,174,880	30,603,141	11,698,098	64,225,987	127,557,853
1922	12,326,445	11,905,734	18,395,514	10,926,278	39,374,536	92,928,507
1921	6,730,189	8,800,525				90,351,001
1920	10,830,537	10,046,761				83,955,056
1919	5,399,805	6,513,306				
1918	6,155,083	12,252,614				
1917	7,085,463	16,921,706				
1916	7,471,267	15,491,982				
1915	6,209,870	11,676,023				
1914	6,365,669	8,872,388				
1913	5,655,702	9,896,974				
1912	5,373,814	8,812,675				
1911	5,128,000	8,453,215				
1910	5,573,801	6,454,330				

COMMERCE OF PORT OF NEW YORK

Net Tonnage
(Short tons)

Calendar Year	Foreign		Domestic		Local	Total
	Imports	Exports	Receipts	Shipments		
1909	5,279,036	5,862,359				
1908	4,775,986	7,765,433				
1907	5,145,000	7,172,000				
1906	4,315,000	7,467,000				
1905	4,160,000	5,206,000				
1904	4,216,000	5,476,000				
1903	4,735,000	6,186,000				
1902	3,524,561	6,432,384				
1901	3,629,600	6,802,494				
1900	3,900,000	6,900,000				
1899	3,600,000	7,504,510				
1898	2,750,000	6,500,000				
1897	2,500,000	3,500,000				

Note: Complete records of domestic and local commerce are not available for the years previous to 1922.



NET TONNAGE OF COMMERCE

PORT OF NEW YORK

COMMERCE OF PORT OF NEW YORK

Valuation (Dollars)

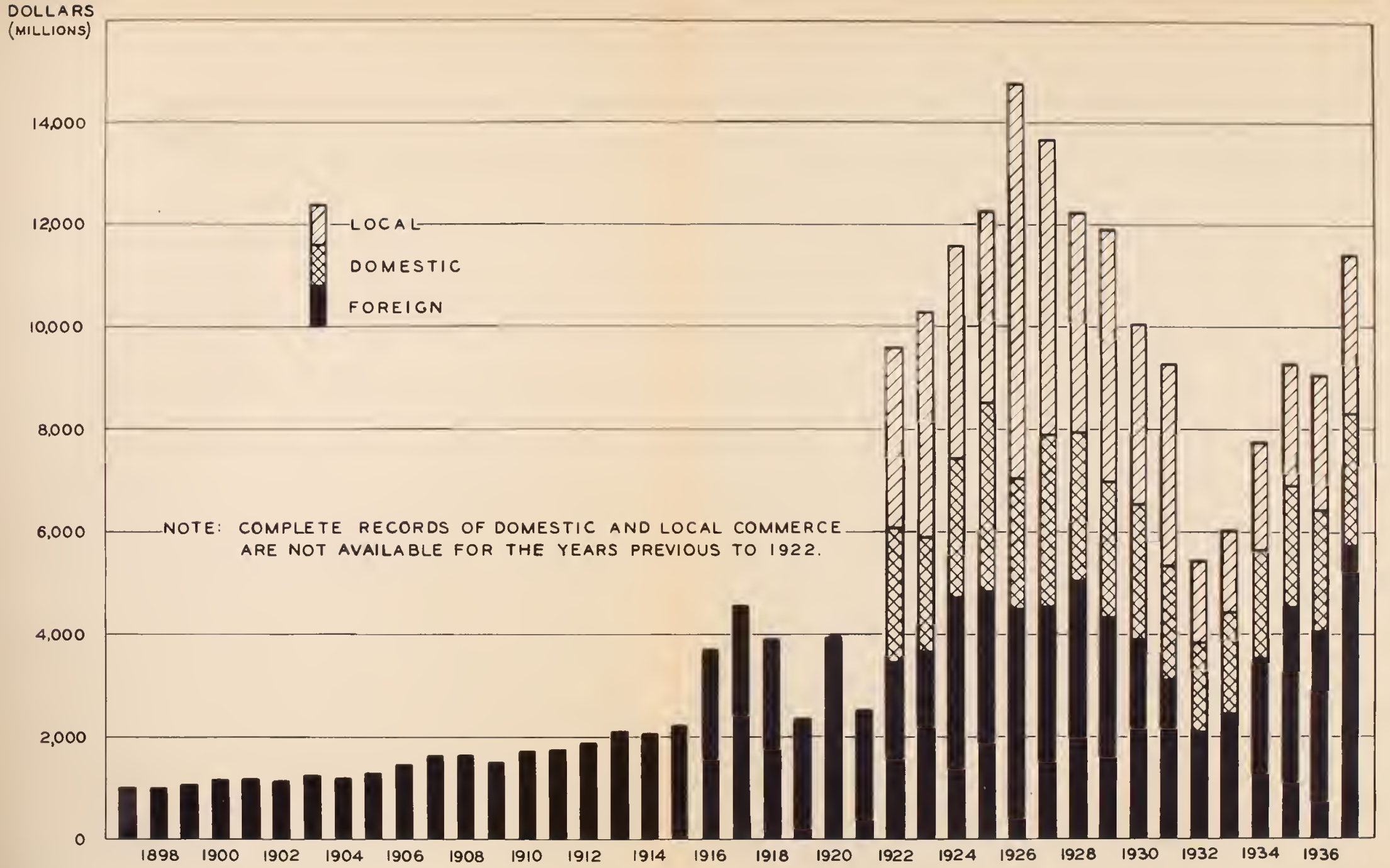
Calendar Year	Foreign		Domestic		Local	Total
	Imports	Exports	Receipts	Shipments		
1937	4,018,747,607	1,716,884,412	1,347,688,330	1,254,569,704	3,071,199,528	11,409,089,581
1936	2,913,002,026	1,157,885,357	1,240,786,811	1,114,823,459	2,614,061,451	9,040,559,104
1935	3,255,801,546	1,324,513,565	1,225,769,746	1,111,745,545	2,384,030,556	9,301,860,958
1934	2,113,398,007	1,442,314,755	1,149,112,476	951,750,789	2,083,466,769	7,740,042,796
1933	1,426,018,738	1,019,799,163	1,084,510,729	874,973,088	1,613,410,314	6,018,712,022
1932	1,279,637,538	825,707,748	993,835,754	780,636,506	1,590,659,128	5,435,765,747
1931	1,618,197,154	1,548,947,379	1,212,198,184	994,605,025	3,936,003,520	9,309,951,262
1930	1,998,702,574	1,927,046,847	1,581,650,866	1,062,064,619	3,503,727,853	10,073,192,759
1929	1,706,560,293	2,648,844,427	1,334,636,803	1,328,564,343	4,906,629,499	11,925,235,365
1928	2,246,598,231	2,823,661,820	1,521,976,294	1,354,700,736	4,271,170,506	12,218,107,587
1927	2,185,073,770	2,357,642,405	1,585,157,380	1,794,005,398	5,794,051,250	13,715,930,203
1926	2,203,738,589	2,283,256,636	1,345,693,705	1,212,726,590	7,720,256,527	14,765,672,047
1925	2,112,187,080	2,734,538,147	1,850,054,461	1,814,909,586	3,784,242,373	12,295,931,647
1924	1,798,876,005	2,990,079,603	1,492,660,514	1,141,296,215	4,177,948,860	11,600,861,197
1923	1,787,900,491	1,878,351,861	1,407,282,961	803,821,421	4,420,730,738	10,298,087,472
1922	1,581,413,174	1,873,990,902	1,487,953,539	1,130,733,378	3,502,348,621	9,576,439,614
1921	836,137,944	1,657,762,303				6,944,482,306
1920	1,649,078,148	2,305,695,232				11,372,429,174
1919	1,014,162,985	1,327,305,187				
1918	1,251,386,373	2,665,969,000				
1917	1,397,073,071	3,189,667,205				
1916	1,371,429,189	2,372,000,824				
1915	975,857,421	1,240,480,097				
1914	1,078,294,984	978,552,238				
1913	1,097,230,251	1,043,012,806				
1912	1,008,140,996	907,503,237				
1911	917,121,800	827,755,334				
1910	952,776,510	774,229,547				

COMMERCE OF PORT OF NEW YORK

Valuation (Dollars)

Calendar Year	Foreign		Domestic		Local	Total
	Imports	Exports	Receipts	Shipments		
1909	799,944,596	721,971,494				
1908	805,962,734	807,068,532				
1907	914,918,529	698,191,855				
1906	794,639,232	666,173,124				
1905	695,166,950	616,294,631				
1904	600,171,033	602,103,775				
1903	663,939,113	578,311,820				
1902	574,066,854	570,962,457				
1901	554,691,683	633,535,949				
1900	562,002,535	615,460,500				
1899	518,040,409	541,773,504				
1898	496,397,952	486,238,059				
1897	556,948,811	467,624,806				

Note: Complete records of domestic and local commerce are not available for the years previous to 1922.

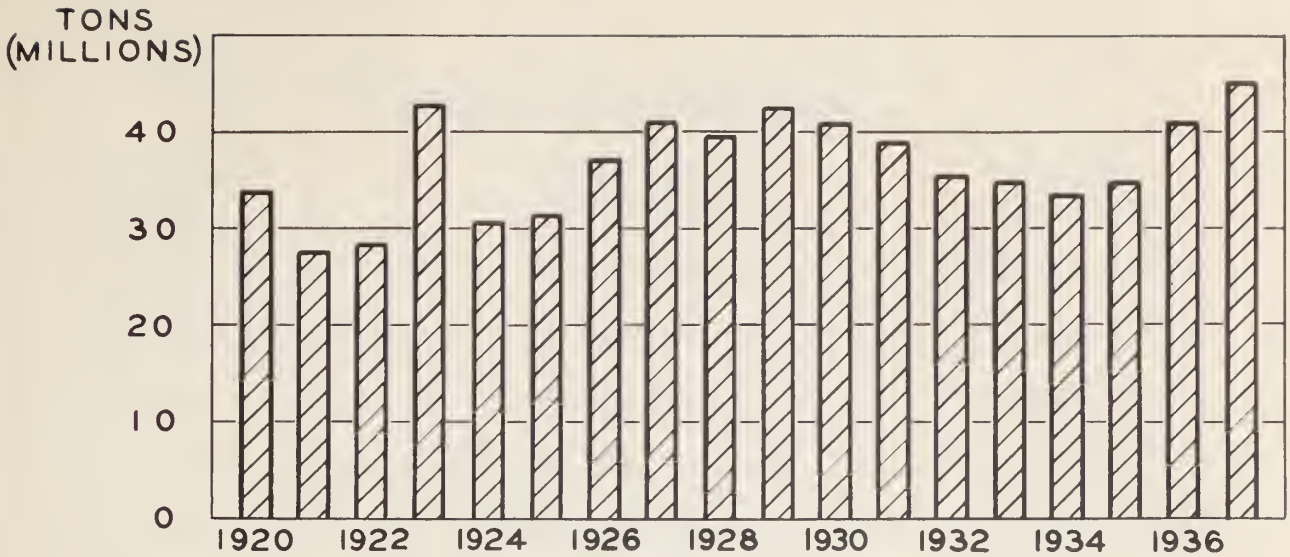


NET VALUE OF COMMERCE

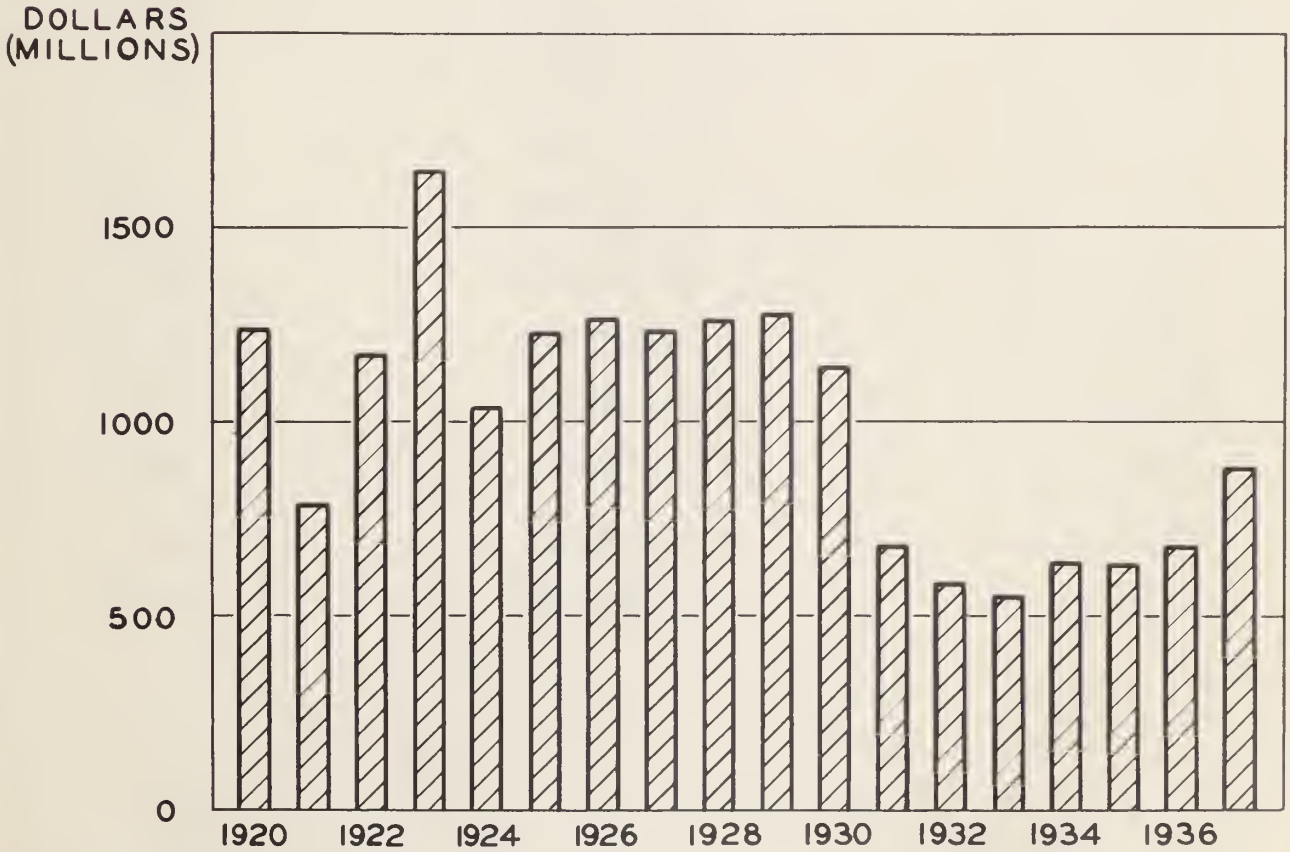
PORT OF NEW YORK

COMMERCE OF NEW YORK AND NEW JERSEY CHANNELS

Calendar Year	Net Tonnage (Short Tons)	Valuation (Dollars)
1937	45,034,822	887,992,169
1936	40,747,102	674,083,959
1935	34,635,315	637,112,480
1934	33,518,851	642,831,815
1933	34,469,463	551,641,903
1932	35,599,475	588,944,630
1931	38,476,514	674,494,685
1930	40,822,181	1,145,509,892
1929	42,536,620	1,281,894,678
1928	39,707,855	1,259,249,008
1927	41,199,416	1,234,415,723
1926	37,136,385	1,262,972,388
1925	31,344,879	1,223,922,400
1924	30,336,076	1,035,782,035
1923	42,679,316	1,649,326,699
1922	28,354,670	1,168,562,387
1921	27,808,857	788,510,341
1920	33,982,966	1,242,367,128



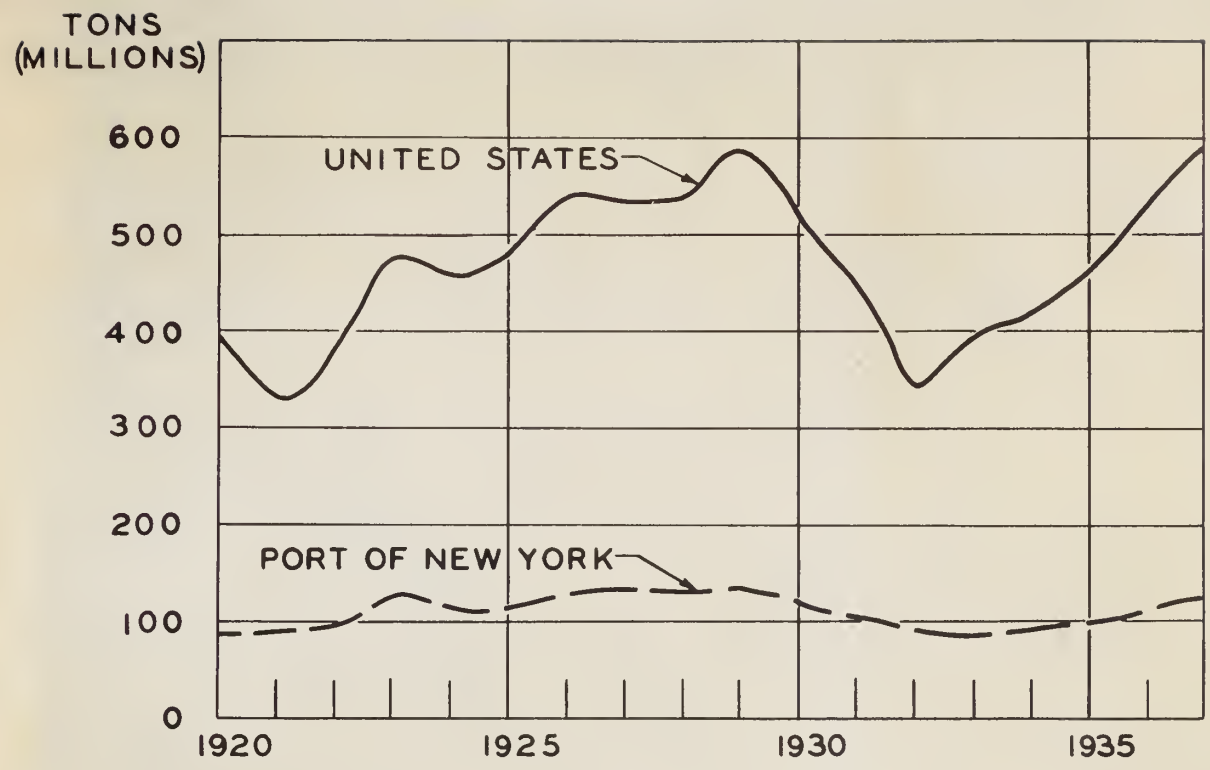
NET TONNAGE OF COMMERCE
NEW YORK AND NEW JERSEY CHANNELS



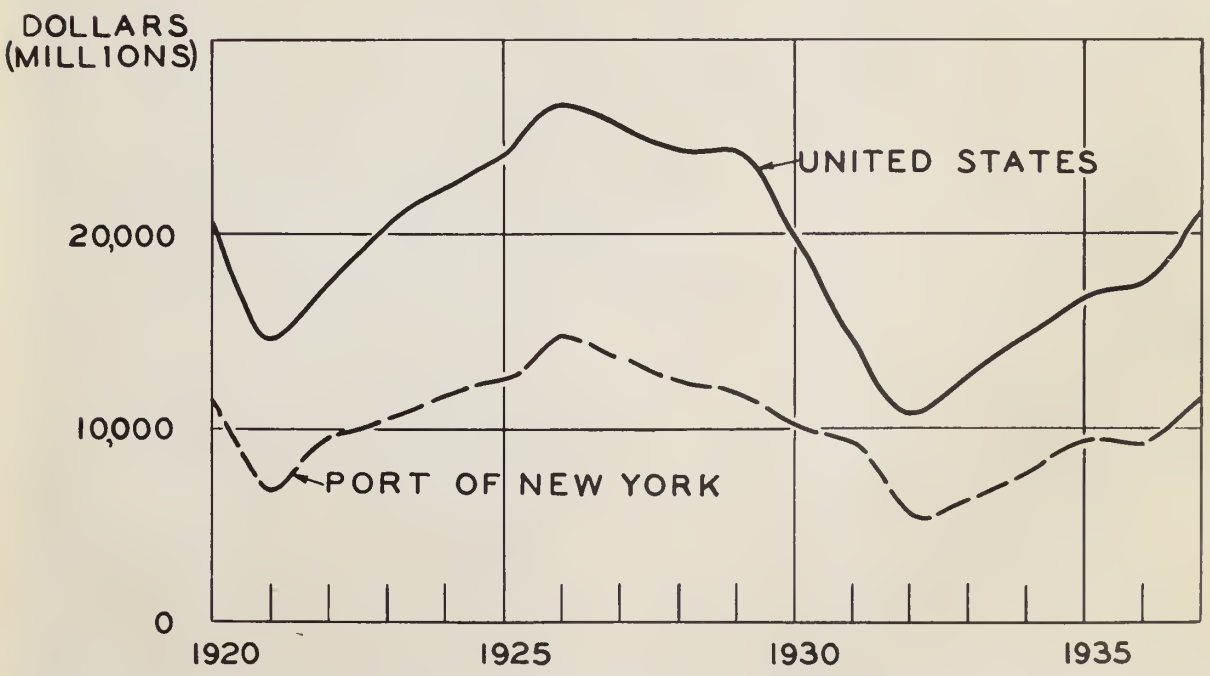
NET VALUE OF COMMERCE
NEW YORK AND NEW JERSEY CHANNELS

COMMERCE OF THE UNITED STATES

Calendar Year	Net Tonnage (Short tons)	Valuation (Dollars)
1937	583,100,000	20,900,000,000
1936	525,842,000	17,448,000,000
1935	453,331,000	16,889,000,000
1934	414,308,000	14,714,000,000
1933	394,104,000	12,597,000,000
1932	342,488,723	10,910,429,345
1931	445,648,000	14,935,000,000
1930	520,280,000	20,122,000,000
1929	583,800,000	24,311,000,000
1928	539,200,000	24,159,000,000
1927	532,500,000	25,555,000,000
1926	540,500,000	26,722,000,000
1925	483,400,000	23,946,000,000
1924	453,700,000	22,115,000,000
1923	478,000,000	20,175,000,000
1922	376,000,000	17,504,000,000
1921	332,000,000	14,329,000,000
1920	399,000,000	20,531,000,000



COMPARISON OF NET TONNAGE OF COMMERCE
UNITED STATES AND PORT OF NEW YORK



COMPARISON OF NET VALUE OF COMMERCE
UNITED STATES AND PORT OF NEW YORK